

DRAINAGE INVENTORY PRELIMINARY FINDINGS MEMO

Farming in the Floodplain Project

Prepared for
PCC Farmland Trust

November 2016



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1.0 Project Background and Description

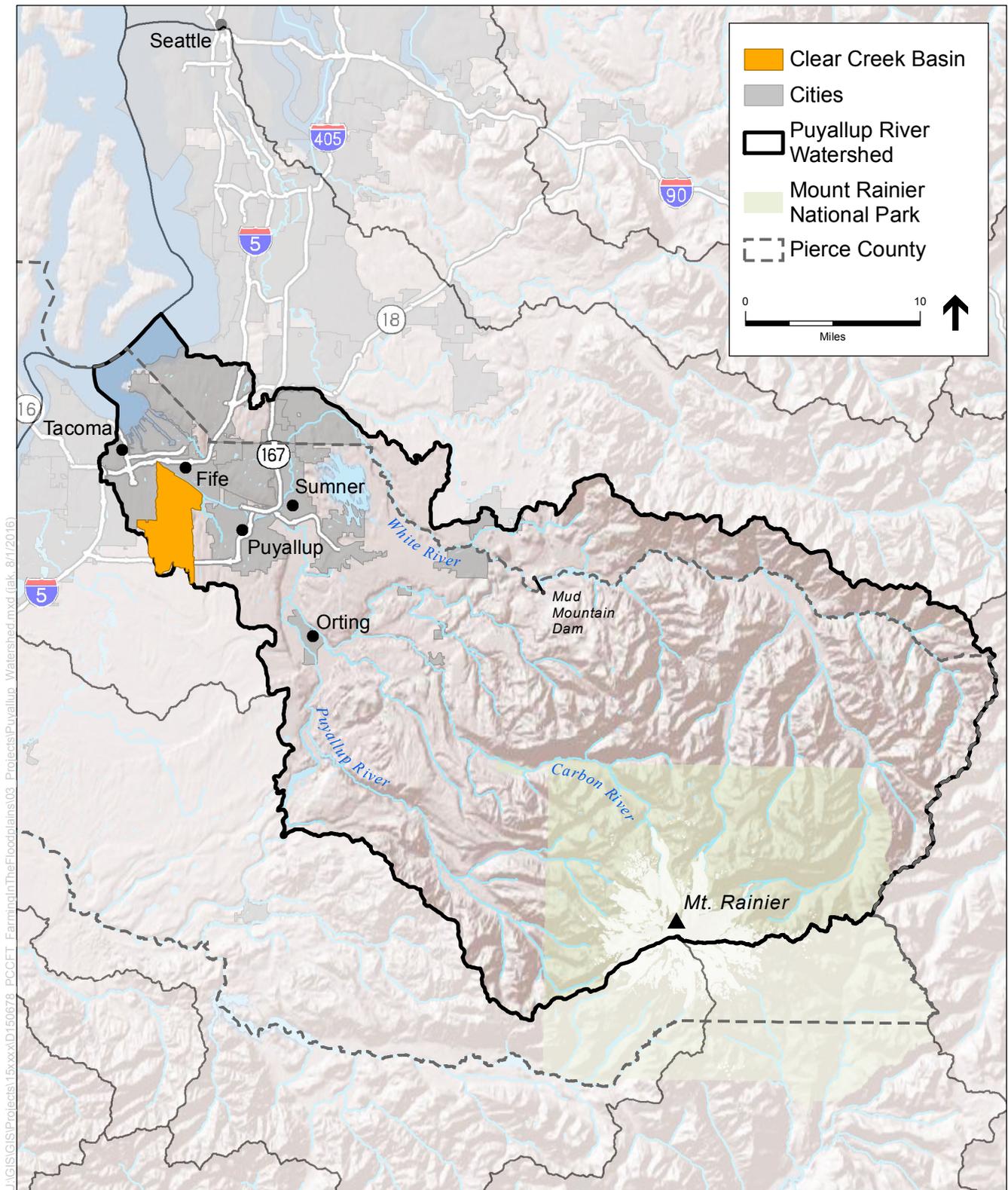
This memorandum has been prepared as part of the second phase of the Farming in the Floodplain Project (FFP). The FFP is one of four components of the Floodplains for the Future: Puyallup, White, and Carbon Rivers project, which is funded by a Floodplains by Design grant from the Washington Department of Ecology (Ecology). The purpose of the FFP is to advance progress toward a collectively agreed upon plan for the Clear Creek area that improves agricultural viability in the area while also meeting goals for flood risk reduction and salmon habitat enhancement. The FFP is intended to clarify the needs and interests of the agricultural community within the Clear Creek area.

As part of the second phase of the FFP, ESA has undertaken an inventory of the agricultural drainage system in the Clear Creek area. The purpose of the drainage inventory is to provide an improved map and qualitative information on the agricultural drainage system that can be used in the future to inform the planning and design of projects such as the proposed Clear Creek Floodplain Reconnection Project, projects undertaken by Drainage District 10 or individual landowners, and other multiple-benefit projects in the area to ensure they improve agricultural drainage. The drainage system inventory is for planning purposes only; it is not detailed enough to develop permit applications or design plans for actions that would modify or alter the drainage network.

This memorandum includes preliminary findings from field work ESA staff conducted in September and October of 2016. Additional work will be done from November 2016 to March 2017 as part of the agricultural drainage inventory, and a full memorandum will be issued in spring 2017.

2.0 Study Area

The study area for the agricultural drainage inventory is the Clear Creek area, part of the Clear Creek Subbasin of the Puyallup River Watershed (Figure 1). The Clear Creek Subbasin is within the Puyallup River Watershed and is located south of the Puyallup River, north of 128th Street East, west of 66th Avenue East, and east of McKinley Avenue East. The Clear Creek area is roughly 1.5 square miles (990 acres) in size and bounded by the Puyallup River to the north, Pioneer Way East to the south and west, and 52nd Street East to the east. The Clear Creek area is located primarily within unincorporated Pierce County, with the northern tip of the area within the City of Tacoma and the southern tip within the City of Puyallup. It encompasses a portion of State Route 167 (SR 167), a section of the BNSF Railroad, agricultural lands, single-family residential neighborhoods, a recreational vehicle (RV) park, a few commercial properties, the Riverside Fire District, and two schools (Chief Leschi High School and ReLife School).



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SOURCE:
 ESA, 2016; King County, 2015; Pierce County, 2013; Ecology, 2007;
 OSM, 2016; WDNR, 2010

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Figure 1
 Puyallup Watershed

3.0 Methodology

ESA field investigators completed an inventory of drainage ditches and culverts in the Clear Creek area by taking measurements and recording information in the field. A Global Positioning System (GPS) unit was used to record drainage ditch and culvert locations and other points of interest, which included bends in the drainage channel, road crossings, and junctions with other ditches. All measurements were taken using a stadia rod and/or measuring tape and recorded to the nearest tenth of a foot. At each point of interest within a drainage ditch the following data were recorded:

- Channel measurements – width and depths of channel banks, surface water (if present), and sediment.
- Channel Condition – type of substrate and vegetation within the channel; type and density of vegetation adjacent to the channel; overall condition and stability of channel banks.

In addition to the information above, field investigators recorded any observed debris in the channel and noted potential maintenance needs in the surrounding area.

At culvert locations, field investigators recorded the following information at each culvert:

- Culvert diameter.
- Culvert type (corrugated metal, plastic, etc.) and shape (round, box, etc.).
- Crossing type (i.e., road, railroad, etc.).
- Condition – presence of flow impediments at culvert entrance; material condition (rusted, eroded, etc.); and presence of scour pools.

In addition to the information above, field investigators noted if a culvert was perched above the channel.

Data sheets with the above observations are included in a separate appendix available online at www.farminginthefloodplain.org. The data sheets contain field notes and are not considered final technical documents.

Throughout this memo, we have classified ditches using the approach defined in the *Drainage Management Guide for Whatcom County Drainage Improvement Districts*, prepared by the Whatcom Conservation District in 2009. The *Drainage Management Guide* classifies ditches as being natural, modified, or constructed. Natural watercourses are those “that have not been significantly altered from their historical flow path or floodplain.” Modified watercourses are “historically natural systems that have been diverted, dredged, straightened, and/or diked.” Constructed watercourses are ditches with no headwaters or other natural water sources. Because the purpose of this memo is to focus on agricultural drainage, other classification systems, such as Forest Practices Water Typing, have not been used.

Ditches were assigned numbers in the field. Throughout this memo, ditches are referred to by name when a name is known. Roadside ditches are referred to by the name of the corresponding road. Other ditches are referred to by the number assigned in the field. Because some ditches are referred to by name or by corresponding road, the numbers of ditches described in this memo are not consecutive.

The inventory is not comprehensive and does not include all drainage ditches and culverts in the Clear Creek area due to constraints on the amount of field time available. Areas to cover in the inventory were prioritized for importance to the overall drainage system based on preliminary mapping and feedback from farmers and landowners in the area.

Local farmers and landowners provided critical assistance throughout the field investigation, including providing access, showing field investigators the locations of ditches and culverts, and providing additional information on drainage conditions.

4.0 General Observations

This section includes general observations made by the ESA field crew while collecting drainage ditch and culvert measurements. Additional field work, research, and evaluation and synthesis of data need to be conducted before findings and recommendations can be developed.

Reed canarygrass appears to be the biggest maintenance issue for the agricultural drainage system in the Clear Creek area. Most ditches were observed to have silty sediment along the bed of the ditch. These observations are consistent with the results of research, observation, and feedback from landowners in the area documented in the July 2016 *Existing Conditions Report* prepared by ESA for the Farming in the Floodplain Project. The field crew observed that most culverts in the area appear to be undamaged, but many appear to be at least partially obstructed by sediment, reed canarygrass, and/or blackberries.

The field crew was informed by a local landowner that South Ditch no longer flows directly into Clear Creek and was able to confirm this through observation. We were informed that, due to sediment deposit in Clear Creek, the creek is now higher than the ditch, preventing drainage from the ditch into the creek. Subsequently, the ditch outlet to Clear Creek has been filled in. It is unclear how or when this occurred.

Instead of flowing west into Clear Creek, South Ditch now drains to three seemingly poorly maintained and narrow private drainage ditches (Figure 2). These ditches carry flows from South Ditch north to the roadside drainage ditch on the south side of 44th Street. From there, water flows into Nancy's Ditch, where it flows north then west, entering Clear Creek approximately 4,000 feet downstream of the original outlet of South Ditch.

ESA staff were informed by a Drainage District 10 Commissioner that the current drainage situation for South Ditch does not have a substantial effect on the drainage system as a whole because few fields drain to South Ditch and there is not much flow of water in the ditch. However, because South Ditch has a substantially higher carrying capacity than the roadside ditch

on 44th Street, the current drainage pattern could be contributing to drainage issues around 44th Street. ESA staff plan to observe drainage conditions around South Ditch and 44th Street this winter when water levels are higher.

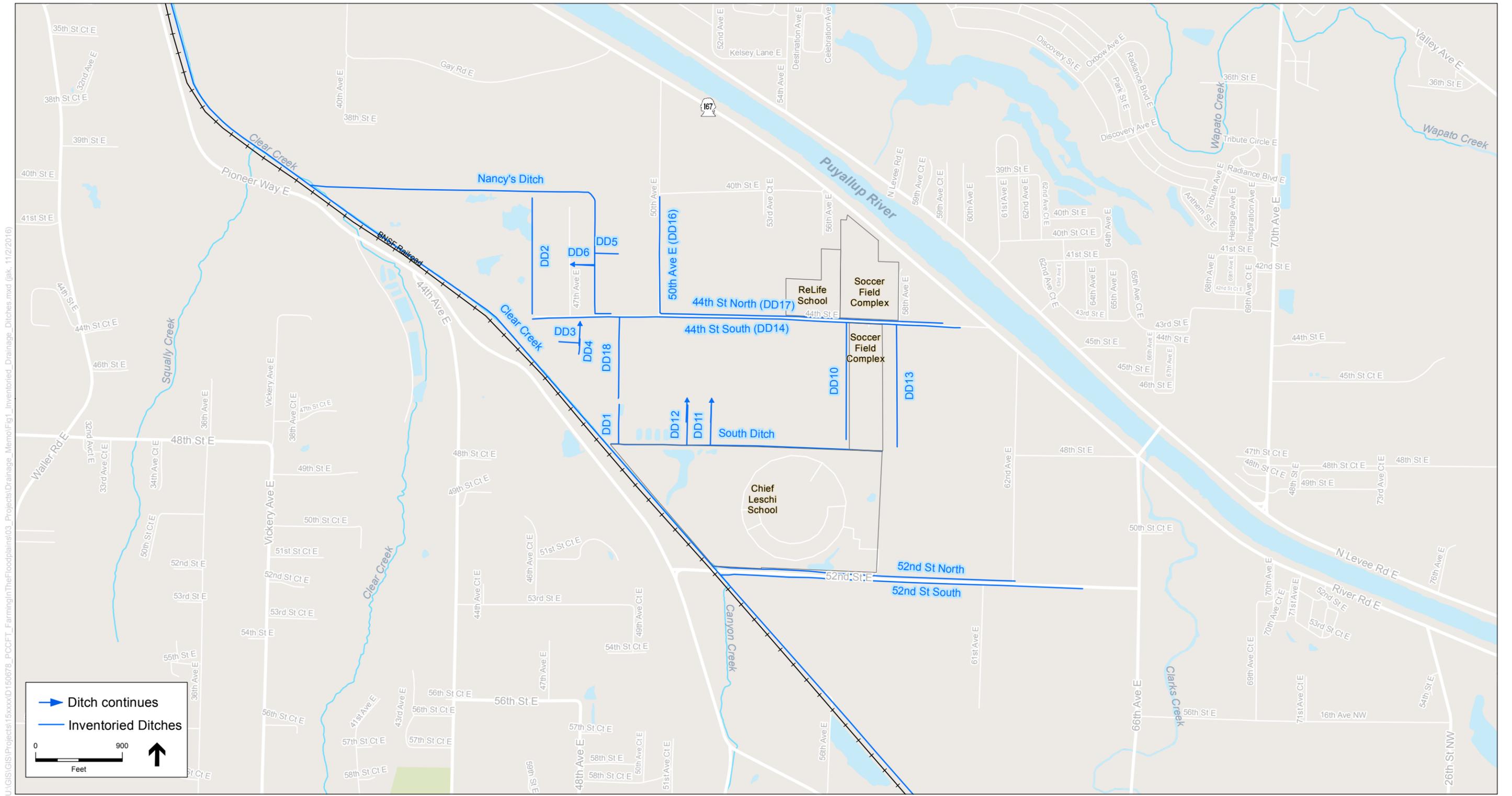
In general, agricultural drainage in the Clear Creek area could benefit from the following:

- Reduction of sediment (by addressing sediment sources, accumulated sediment, or both),
- Removal of invasive plant species,
- Planting of vegetation on banks (“hedgerows”) to stabilize soil and provide shade to discourage invasive plant species,
- Replacement of culverts that impede drainage, and
- Flattening of the slope of banks where they are slumping.

More detailed recommendations for improving agricultural drainage in the Clear Creek area will be included in a full draft memorandum in spring 2017 (see Section 6.0 below).

5.0 Results of Field Investigation

Field investigation for the agricultural drainage inventory took place September 20 through 24, September 27, and October 12, 2016. Observations from the field investigation are presented below by drainage ditch. Figure 2 shows the drainage ditches inventoried during the field investigation. Figures 3a and 3b show the locations of inventoried culverts. The figures only show drainage features inventoried during the field work and do not show other drainage features that we have been informed about or observed in the field but were not able to inventory (such as the roadside drainage ditch on the west side of 50th Avenue). The figures also do not show the field crew’s assumptions about connections that were not directly observed.



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SOURCE: ESA 2016; OSM 2015; Wa Ecology 2015

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Figure 2
Inventoried Drainage Ditches

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SOURCE: ESRI, 2016; ESA, 2016

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Figure 3a
Inventoried Drainage Ditches and Culverts

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SOURCE: ESRI, 2016; ESA, 2016

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Figure 3b
Inventoried Drainage Ditches and Culverts

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5.1 Clear Creek

Overview. Clear Creek is a modified watercourse that serves as the primary ditch for agricultural drainage in the Clear Creek area in addition to draining four tributaries (Canyon Creek, upper Clear Creek, Squally Creek, and Swan Creek). Clear Creek originates at the southern portion of the Clear Creek area and continues to flow in a northwest direction along the western boundary of the Clear Creek area (Pioneer Way and the BNSF Railway line). At 52nd Street East, Canyon Creek flows into Clear Creek via a railroad crossing culvert (CC-Culvert 6). Upper Clear Creek enters Clear Creek near Pioneer Way and 44th Avenue East via a railroad crossing culvert (CC-Culvert 3). Squally Creek also drains into Clear Creek, approximately 500 feet downstream of Nancy's Ditch via a railroad crossing culvert (CC-Culvert 40). Swan Creek joins Clear Creek north of Pioneer Way East, and Clear Creek continues approximately 0.15 mile to join the Puyallup River. The Puyallup River empties into Commencement Bay approximately 3 miles downstream from this confluence.

Water Flow Observations. At the time of the site visit, field investigators observed continuous water flow in Clear Creek from the Canyon Creek crossing moving northwest to Gay Road East. From this point, the creek continues to flow northwest through a largely residential area then through a Port of Tacoma wetland mitigation site before entering the Puyallup River. The presence of surface water varied in the portion of Clear Creek downstream from the Canyon Creek crossing. Field investigators did not observe surface water at the west and east ends of this portion of Clear Creek; however, field investigators did observe standing water and limited water flow in the central part of this portion.

Channel Condition. Several stretches of the Clear Creek channel were observed to have stable banks. In other areas, unstable and undercut banks were observed. A majority of the channel had a thick layer of soft, very fine sediment, a foot in depth in some areas and over 3 feet in depth in other areas. The bank height ranged from 3.8 feet to 10 feet, and the width ranged from 18 to 40 feet at the top of the bank. Water levels ranged from just under 1 foot to approximately 7 feet above the bottom of the ditch.

Vegetation. Throughout Clear Creek field investigators commonly observed dense reed canarygrass growth within the channel and on surrounding channel banks. Within the channel, reed canarygrass was oftentimes so dense it appeared to impede water flow-through in the channel. In other areas, recent maintenance activities had cleared the channel of reed canarygrass (Photo 1). Other species observed growing in the channel in moderate density included duckweed and another aquatic plant species assumed to be elodea. Himalayan blackberry was commonly observed on the channel banks and made areas of the channel inaccessible to investigators.

Immediately downstream of South Ditch along Clear Creek, dense patches of black twinberry, Pacific willow, Sitka willow, red-osier dogwood, red alder and bigleaf maple were observed adjacent to the channel. Along the rest of Clear Creek downstream of South Ditch, investigators observed very limited and scattered shrub and tree species. In general, the width of the vegetated riparian area was limited to approximately 40 feet on the right bank on average. Vegetation is limited on the left bank of the channel, which is bounded by the railroad.



Photo 1. Clear Creek facing downstream from the 52nd Street East culvert



Photo 2. Squally Creek flows through a culvert under the railroad tracks and into Clear Creek



Photo 3. Upper Clear Creek flows into Clear Creek via two culverts that cross under the railroad tracks



Photo 4. Canyon Creek (left) flows into Clear Creek

Culverts. Tributaries of Clear Creek (Canyon Creek, upper Clear Creek, and Squally Creek) enter Clear Creek through several culverts crossing under the BNSF Railway line (Photos 2 through 4). The majority of these culverts range between 4 and 6 feet in diameter. A number of culverts appeared to be partially obstructed by sediment and/or reed canarygrass. Clear Creek crosses through culverts under 52nd Street East and Gay Road East. At the inlets for the Gay Road East culvert, woody debris, a very large rock, and trash debris were observed.

5.2 Nancy's Ditch

Overview. Nancy's Ditch is a constructed watercourse which originates at 44th Street East, east of 47th Avenue East. It continues north for a quarter mile then turns to the west and continues for approximately a half mile before draining into Clear Creek via four small culverts. Photo 5 shows the north end of the north-south reach of Nancy's Ditch.

Water Flow Observations. Through a series of north-south oriented private drainage ditches, Nancy's Ditch drains South Ditch and 44th Street roadside ditches. Water depths in Nancy's Ditch ranged from 1.9 feet to 4.9 feet above the bottom of the ditch, but little to no water flow was observed throughout the length of the ditch.

Channel Condition. The majority of the channel banks appeared to have limited areas of erosion and undercut banks. Field investigators observed a thick layer of silty sediment along the channel bed, measuring roughly 2.5 feet deep in places. In addition, the channel ranged between 15 and 26 feet in width at the top of the bank.

Vegetation. A high density of duckweed was observed covering the majority of the water surface in the channel (Photo 6). Reed canarygrass was also very dense along both banks for the entire length of Nancy's Ditch. In many areas of the channel, reed canarygrass was observed growing within the channel, impeding water flow, and potentially raising the water level upstream and slowing velocity.



Photo 5. North end of north-south reach of Nancy's Ditch, facing south.



Photo 6. East-west reach of Nancy's Ditch. Reed canarygrass is dense on the banks and edges of the channel. Duckweed dominates the water surface

Most of Nancy's Ditch lacks a vegetated riparian corridor. However, there were points along the east-west portion of the channel where large shrubs and trees dominated an approximately 45-foot-wide zone on both banks. Dominant tree and shrub species observed at these points included red alder, black cottonwood, Oregon ash, Pacific willow, Sitka willow and red osier dogwood. Closer to the south end of Nancy's Ditch, investigators observed dense Himalayan blackberry on the west bank of the channel.

Culverts. Four small culverts were observed under a crossing near the intersection of Nancy's Ditch and Clear Creek.

Two culverts were observed at the south end of Nancy's Ditch. One culvert connects the 44th Street North ditch to Nancy's Ditch (ND Culvert 5), and the other connects 44th Street South Ditch to Nancy's Ditch (DD14 Culvert 7).

Connecting Private Ditches. Two private drainage ditches connect to the north-south portion of Nancy's Ditch, Drainage Ditch 5 and Drainage Ditch 6. Drainage Ditch 5 flows west from a private property, connecting to the east bank of Nancy's Ditch. A culvert was observed in the ditch (DD5-Culvert 1). The culvert appeared to be partially obstructed by sediment and dense reed canarygrass. Drainage Ditch 6 drains east through private property and connects to the west bank of Nancy's Ditch. Water and water flow into Nancy's Ditch was observed coming from Drainage Ditch 6.

Another private drainage ditch (Drainage Ditch 2) parallels the north-south portion of Nancy's ditch and ends approximately 12 feet south of a point along the east-west portion of Nancy's Ditch. According to the owner of the property that includes Drainage Ditch 2, there is an unmaintained culvert connecting Drainage



Photo 7. Water in western portion of 44th Street North ditch and DD17-Culvert 5



Photo 8. Culvert partially obstructed by reed canarygrass in 44th Street North ditch

Ditch 2 to Nancy's Ditch at this point. However, field investigators did not observe the culvert during the September site visit. Investigators did observe silty substrate and dense reed canarygrass growth in the channel. It is likely that if a culvert is present, it may be buried and not functioning properly. In addition, based on the location and direction of water flow in Drainage Ditch 6 (east into Nancy's Ditch) it is possible that water in Drainage Ditch 2 flows into Drainage Ditch 6.

The other end of Drainage Ditch 2 is located just north of the 44th Street North ditch and west of 47th Avenue East.

5.3 44th Street North Ditch

Overview. The 44th Street North Ditch is a roadside drainage ditch (constructed watercourse) located on the north side of 44th Street that begins near River Road East and flows west until it is joined by the 50th Avenue East ditch (Drainage Ditch 16). From this point west, there was no ditch observed on the north side of 44th Street except a short separate portion of the ditch starting approximately 150 feet east of Nancy's Ditch.

Water Flow Observations. During the September site visit, field investigators did not observe any water in the channel from River Road East to 50th Avenue East. It was also unclear where water in the 44th Street North Ditch would flow at the junction with 50th Avenue East. No culvert connecting this portion of the ditch to the western portion of the ditch was observed. However, there was very dense reed canarygrass observed at the end of the ditch at both segments, so it is possible that there is a culvert that is not readily visible. Field observations during the wet season could help in understanding the flow of water here.

Unlike the east portion of the channel, water levels in the western portion of the channel were up to 1 foot above the bottom of the ditch. Flow was very slow and in the westerly direction towards Nancy's Ditch.

Channel condition. The channel was observed to have stable banks. The channel ranged between 10 and 18 feet in width at the top of the bank, and had silty sediment within the channel bed.

Vegetation. There was very dense reed canarygrass growing in and on the banks along the majority of 44th Street North Ditch (Photo 7). In the separate western portion of the ditch, less dense reed canarygrass was observed and duckweed was dominant where surface water was present. The channel appeared to be maintained from the front of ReLife School to the east end of the ditch. There is short weedy vegetation in the channel, but little to no reed canarygrass along this portion.

Culverts. A total of 10 culverts were observed in the 44th Street North ditch, mostly under driveway and road crossings. All ranged between 1 and 2 feet in diameter. Some culverts appeared to be partially obstructed by sediment and by dense reed canarygrass growing in the channel (Photo 8).

The culvert (ND-Culvert 5) at the west end of the 44th Street North ditch drains this portion of the ditch into Nancy's Ditch. It was unclear during the September site visit if there was a culvert connecting the eastern and western portions of the 44th Street North ditch past 50th Avenue East.

5.4 44th Street South Ditch

Overview. The 44th Street South Ditch is a roadside drainage ditch (constructed watercourse) located along the south side of 44th Street. It begins at River Road East and continues west to the end of 44th Street.

Water Flow Observations. Several adjacent agricultural fields likely drain through private ditches into 44th Street South Ditch. In addition, there are three private north-south oriented ditches that likely drain South Ditch into the 44th Street South ditch. Water drains from 44th Street South into Nancy's Ditch, eventually draining into Clear Creek.

During the September site visit, field investigators did not observe any water in most of the eastern portion of 44th Street South Ditch. Some stagnant water was observed directly to the east of Nancy's Ditch. At a later site visit conducted on October 12, 2016, following a short period of rain, water was observed in the channel farther east towards 50th Avenue East.

Water was observed in the channel just west of Nancy's Ditch at approximately 1 foot above the bottom of the ditch with little to no water flow. Water flow was observed coming from the west at the entrance of the culvert that connects the 44th Street South ditch to Nancy's Ditch.

Channel condition. In general, the channel appears have stable banks. A layer of silty sediment was observed along the channel bed and over 1 foot deep in some areas. The channel ranged between 10 and 14 feet in width at the top of the bank.

Vegetation. Similar to the 44th Street North Ditch, dense reed canarygrass was observed growing in the channel and on the banks for the majority of its length. In areas with less dense reed canarygrass and standing water, duckweed was dominant. The ditch appears to be maintained starting at the west side of the soccer field parking lot (Photo 9). There is short weedy vegetation in the ditch and little to no reed canarygrass from this point to the east end of the channel.

Culverts. There were 24 culverts observed along the length of the 44th Street South ditch, mostly under driveways and the road shoulder. Photo 10 shows an example culvert on the 44th Street South ditch. Many culverts appeared to be partially obstructed by sediment, reed canarygrass, and/or Himalayan blackberry.

Field investigators observed two culverts that drain the 44th Street South Ditch. One culvert (DD14-Culvert 7) crosses north under 44th Street and drains into Nancy's Ditch. According to a local landowner, drainage issues south of 44th Street began when a larger culvert that drained into Nancy's Ditch was replaced with the current culvert that is much smaller in size. This has not been confirmed by ESA staff at this time.

A second culvert (DD17-Culvert 5) crosses northwest under 44th Street from 44th Street South Ditch and drains into the 44th Street North ditch. Very low water flow was observed at the

entrances to these culverts. In addition, a perched culvert (DD14-Culvert10) was observed on top of DD17-Culvert 5 approximately 1.9 feet above the channel bed (Photo 11). Unlike DD17-Culvert 5, DD14-Culvert 10 is oriented east-west. The fact that the culvert is perched likely impedes the westerly flow of water in the 44th Street South ditch east of this point when the water level is below the culvert. However, DD17-Culvert 5 is located at the bottom of the channel below DD14-Culvert 10, so even when the water level is low, drainage of the eastern portion of 44th South Ditch to the 44th North Ditch could still potentially occur.

Connecting Private Ditches. As previously mentioned, several adjacent agricultural fields are presumed to drain to the 44th Street South Ditch via private ditches. These ditches include Drainage Ditches 3, 4, 10, 13 and 18. Drainage Ditches 10, 13, and 18 are oriented north-south and connect to 44th Street South Ditch. Drainage Ditches 11 and 12 are also oriented north-south and are presumed to connect to 44th Street South Ditch, though these connections were not observed. Drainage Ditch 3 is oriented east-west and drains to Drainage Ditch 4, which is oriented north-south toward 44th Street South Ditch through private property. Drainage Ditch 4 is also presumed to connect to 44th Street South, though this connection was not observed. Water and limited water flow were observed in the two channels. A culvert (DD4-Culvert 1) was observed in Drainage Ditch 4 approximately 45 feet north of the intersection with Drainage Ditch 3. Field investigators did not observe the other end of the culvert, but it is likely, due to its orientation and location, that Drainage Ditch 4 drains to 44th Street South Ditch.



Photo 9. 44th Street South ditch adjacent to the soccer fields



Photo 10. 44th Street South ditch and culvert, west of 50th Avenue East



Photo 11. Perched culvert in 44th Street South ditch. A second culvert that flows under the road and into 44th Street North ditch is located below it in the channel.

5.5 South Ditch

Overview. South Ditch is a constructed watercourse oriented east to west, originating at the southeast corner of the River Jam Field soccer complex and ending approximately 100 feet east of Clear Creek. South Ditch is located directly north of Chief Leschi School.

Water Flow Observations. During the September site visit, field investigators did not observe water at the east end of South Ditch. Towards the west end of the channel, water levels were observed to be approximately 3 feet above the bottom of the ditch. Little to no water flow was observed in the channel.

South Ditch is drained via three private north-south oriented ditches. Two of the three ditches likely drain north into the 44th Street South ditch. In addition, there are several man-made ponds just north of South Ditch, one of which is fed by a private ditch.

Channel condition. The condition of South Ditch varied. Field investigators observed areas where the channel had stable banks, and other areas with steep, eroding banks. In addition, the majority of the channel had silty sediment along the bed and ranged between approximately 6 and 20 feet in width at the top of the bank.

Vegetation. South Ditch appeared to be maintained at the east end, south of the soccer fields. No vegetation was observed in the channel and both banks were mowed. Reed canarygrass was the dominant species west of the soccer fields. It was observed growing in dense mats within the channel and along the banks. Duckweed covered much of the water surface in the channel (Photo 12). Black cottonwood, red alder, Pacific willow, Sitka willow, ash, and Himalayan blackberry were observed along the south bank and adjacent to the channel.

Culverts. Field investigators did not observe any culverts along South Ditch. However, there could potentially be a buried and/or obstructed culvert given the observed dense vegetation and sediment in the channel at its west end.

There is a concrete footbridge crossing South Ditch at the west end of the soccer fields (Photo 13). It is approximately four feet wide and positioned one foot above the channel bed and could be an impediment to water flow in the ditch under certain conditions when the water level reaches the bridge bottom.

Connecting Private Ditches. As previously mentioned, South Ditch appears to be connected to the 44th Street South ditch by three private north-south oriented ditches. Drainage Ditches 11 and 12 are connected to South Ditch via narrow channels with low water flow and overgrown with reed canarygrass. During the September site visit field investigators could not readily locate the north ends of these ditches due to dense reed canarygrass growth, but it is likely that they drain to 44th Street South Ditch. The ditches appear to be redundant flow paths. Drainage Ditch 1 drains South Ditch north to a pond (Photo 14). A drainage pipe was observed at the west end of South Ditch and south end of Drainage Ditch 1. It is likely that the drainage pipe connects the two ditches. In addition, the south end of Drainage Ditch 18 is likely connected to the Drainage Ditch 1 pond via a culvert (DD18-Culvert 1), thereby allowing water to drain from Drainage Ditch 1 to 44th Street South Ditch.

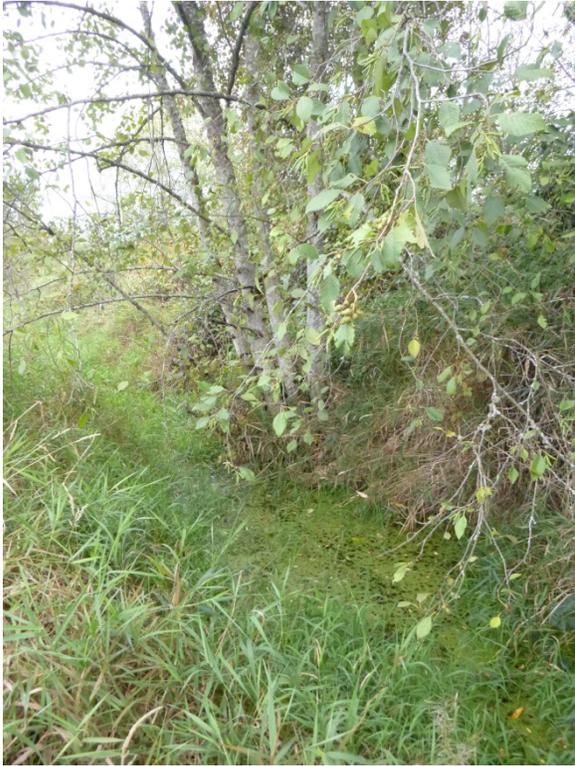


Photo 12. South Ditch between Drainage Ditches 11 and 12. Dense reed canarygrass dominates both banks. Duckweed is dense in the channel. Red alder overhangs the channel.



Photo 13. South Ditch is maintained south of the soccer fields.

5.6 50th Avenue East Ditch

Overview. The 50th Avenue East ditch (Drainage Ditch 16) is a roadside drainage ditch (constructed watercourse) oriented north-south on the east side of 50th Avenue. Field investigators collected data from East 40th Street to 44th Street East. A ditch is located on the west side of 50th Avenue, but was not inventoried. No connection from the 50th Avenue West Ditch to 50th Avenue East Ditch was observed.

Water Flow Observations. No water was observed in the ditch until just north of 44th Street East. At this point field investigators observed very shallow standing water with no water flow.

Channel condition. The banks of the channel appeared to be stable with no signs of erosion observed. However, the overall condition of the channel was difficult to assess due to dense reed canarygrass throughout the channel. The channel width remained relatively consistent, ranging between approximately eight and ten feet at the top of the bank.

Vegetation. The entire length of the channel was dominated by reed canarygrass, and no shrubs or trees were present (Photo 15).

Culverts. A culvert along 50th Avenue (DD16-Culvert 1) and one at the corner of 44th Street East and 50th Avenue (DD16-Culvert 2) both had sediment and reed canarygrass appearing to partially obstruct their inlets and outlets. These obstructions prevented field investigators from being able to collect measurements of the culverts. DD16-Culvert 2 appears to be directed east of 50th Avenue to connect 50th Avenue East ditch with 44th Street North ditch; however, the other end of the culvert was not readily found by field investigators.



Photo 14. Drainage Ditch 1, facing north from South Ditch



Photo 15. 50th Avenue East ditch facing south toward 44th Street

5.7 52nd Street East Ditches

Overview. Drainage ditches (constructed watercourses) were observed on each side of 52nd Street East (52nd North Ditch and 52nd South Ditch) that drain to Clear Creek at their western ends. Both the 52nd North Ditch and 52nd South Ditch are oriented east-west and end near a railroad crossing to the west. The 52nd South ditch extends farther east than 52nd North Ditch, nearly to 66th Avenue East. The 52nd North ditch ends at the intersection with 62nd Avenue East. GPS data points were only collected at the west end of the ditches, but the general condition of the ditches was observed along their lengths.

Water Flow Observations. Field investigators did not observe any water at the east ends of the two channels. At the west end of 52nd South ditch, water levels were observed at 1.5 feet above the bottom of the ditch with little flow. In the 52nd North ditch, water levels were 2.5 feet above the bottom of the ditch with very low flow observed in the westerly direction toward Clear Creek.

Channel condition. Signs of erosion were not observed at the west ends of the channels but may have been obscured by the dense vegetation in the channel. The 52nd Street South ditch was 18 feet in width at the top of the bank, and the 52nd Street North Ditch was 25 feet in width at the top of the bank. Both channels had a layer of silty sediment along the bed.

Vegetation. Field investigators observed dense reed canarygrass growing on the banks as well as in the channel of the 52nd Street South ditch (Photos 16 and 17). In open water areas without reed canarygrass growth, there was dense duckweed. East of the intersection of the ditch with Clear Creek, field investigators observed a patch of cattails. Other vegetation on the banks included blackberry, red alder, and black cottonwood. Further east, some vegetation was observed in the channel, but little to no reed canarygrass.

Similar to 52nd Street South ditch, the 52nd North ditch had dense reed canarygrass growing on the banks and in the channel. Water pennywort was also observed growing in a dense mat across the channel at the west end. A patch of dense cattails were also observed to the east of where the 52nd Street North ditch connects to Clear Creek.

Culverts. No data was collected for culverts on 52nd Street East.



Photo 16. 52nd Street North ditch near Clear Creek, facing east



Photo 17. 52nd Street South ditch near Clear Creek, facing east

6.0 Next Steps

The purpose of this Preliminary Findings Memorandum is to share collected data on the agricultural drainage system in advance of the wet season. However, additional steps are being taken as part of the drainage inventory effort, which will be completed in spring 2017. These steps include:

- Presentation of preliminary findings and discussion at the November 2, 2016 Technical Advisory Group meeting,
- Additional field observations in the winter when water levels are higher,
- Research on drainage ownership and maintenance responsibilities,
- Evaluation and synthesis of data collected, and
- Development of a set of recommendations for improvements to the drainage system.

A full draft memorandum will be issued in spring 2017. After a comment period to solicit input on the draft, a final memorandum will be issued.